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(54) **Right angle cable strain relief**

Rechtwinklig geführte Zugentlastung für Kabel

Décharge de traction à angle droit pour des câbles

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US-A- 5 037 175

- **PATENT ABSTRACTS OF JAPAN vol. 13, no. 343 (E-796) 1989 & JP-A-01 100 877 (FUJITSU LTD.)**

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Description

Field of the Invention

This invention generally relates to the art of cable connectors and, particularly, to a right angle cable strain relief for connectors such as optical fiber connectors.

Background of the Invention

Connectors are used for joining light-transmitting optical fiber cables to transmitter devices, receiver devices or to other cables. Optical fiber cables are somewhat delicate in that they can be bent or kinked and damage or destroy the interior buffered fiber of the cable. Therefore, as an optical fiber cable projects away from a connection, it is important that the fiber project in a manner that will not overstress or kink the fiber. Overstressing or kinking can interfere with the signal transmitting capabilities of the fiber.

Of course, the best condition for an optical fiber cable is to project straight away from its connection. However, it is not always possible to extend the cable in a straight line, particularly when the cable is used in compact environments. For example, connections are made to transceiver devices located at the rear of a computer and toward a rear wall. This requires routing or dressing the cable at an angle away from its connection, sometimes a severe angle to the plane of the connection.

In view of the problems identified above and to satisfy various packaging requirements, fiber optic connectors often are provided with right angle boots projecting from the rear of the connectors to maintain the terminated optical fiber cables in smooth angles projecting from the connectors. The boots prevent overstressing or kinking of the buffered fiber and provide an improved strain relief for the cables as the cables are maintained in minimum bend radius parameters.

However, one of the problems with right-angled, booted connectors is that a boot often projects from a connector at a given or f ixed angle, whereas it may be necessary to dress the cable away from the connector at a different angle. Providing an inventory of connectors with boots at various different angles could be an unduly expensive expedient. Consequently, connectors have been provided with right angle boots which rotate about the longitudinal connector axes to different angles and thereby accommodate different packaging/dressing requirements. A problem with such rotatable boots is that, if a cable is terminated to the connector and extends through the boot, rotation of the boot can twist the cable and damage the bufered fiber therewithin.

The US-A-5 037 175 dicloses an optical fiber connector comprising a curved bracket body with yoke ends for the dressing of a fiber cable within confined space.

From the German Patent DE 38 67 51 a tubing-device of a connector is known for protection of flexible electric cable.

This invention is directed to solving the myriad of problems presented above by providing a connector with a unique boot which allows the cable to be moved from a right angle position within the boot to an axial position partially removed from the boot so that the boot can be rotated to different angled orientations without twisting the cable, and the cable thereafter can be repositioned at an angle within the boot, all of these adjustments being made without removing the boot from the connector.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved right angle cable strain relief means of the character described.

This object is achieved with right angle strain relief system as defined in claim 1.

The invention is exemplified herein as embodied in a right angle strain relief system for an optical fiber cable. A fiber optic connector is provided for terminating a fiber of the cable on a longitudinal connector axis. A right angle strain relief boot extends from a rear of the connector. The boot has a cable-receiving passage therethrough and includes a first leg portion and a second leg portion connected by a bend portion. The first leg portion is on the longitudinal connector axis and defines a proximal end of the boot coupled to the rear of the connector. The second leg portion extends transversely of the longitudinal connector axis and defines an open distal end of the boot from which the optical fiber cable extends.

The invention contemplates the provision of slot opening in the boot which extends from the open distal end thereof generally to at least the bend portion in the boot. The slot opening is of a width to allow the optical fiber cable to be moved outwardly of the second leg portion to a position projecting from the first leg portion generally on the longitudinal connector axis. Complementary interengaging coupling means are provided between the proximal end of the boot and the connector to provide for rotation of the boot about the longitudinal connector axis. Therefore, the cable can be moved out of the second leg portion of the boot, through the slot means, and the boot can be rotated to various angular orientations relative to the connector without twisting the cable.

As disclosed herein, the width of the slot opening is approximately the same as the diameter of the cable. However, the slot opening include a mouth near the distal end of the boot which is narrower than the diameter of the cable. The boot is fabricated of flexible material and the mouth provides a snap-fitting restriction post which the cable moves into and out of the cable-receiving passage. The slot means is located in a rearwardly facing side of the boot and extends from the open distal end of the boot substantially through the bend portion in the boot.

Other objects, features and advantages of the in-

vention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is a rear perspective view of a fiber optic connector terminating an optical fiber cable, with the right angle strain relief boot separated from the connector to facilitate the illustration;

FIGURE 2 is a side elevational view of the connector, with a fragmented section through the rear of the cable and the strain relief boot; and

FIGURE 3 is a rear elevational view of the assembly, as looking toward the right-hand side of Figure 2.

Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, the invention is embodied in a right angle strain relief system, generally designated 10 (Fig. 2), for an optical fiber cable 12. The system includes a fiber optic connector, generally designated 14, for terminating a fiber 16 of the cable on a longitudinal axis 18 of the connector. A right angle strain relief boot, generally designated 20, extends from a rear 22 of connector 14.

At this point, it should be understood that the use of the phrase "right angle" herein is not to be considered limiting. In other words, the use of that phrase is not intended to be restrictive to a precise 90° angle of the boot or the system. Although substantially full 90° right angle boots are conventional in the industry, it is understood that the concepts of the invention are equally applicable to boots that might be in configurations at angles more or less than a precise 90° to properly dress cables as they extend away from various connectors.

As best seen in Figure 2, but somewhat in Figure 1, fiber optic connector 14 includes an inner body 24 and an outer housing 26, with a forwardly projecting ferrule 28 within which the end of fiber 16 is terminated. Inner body 24 includes a central passage 30 on connector axis 18 for receiving a distal end 32 of cable 12. Outer housing 26 has an inner rectangular cavity 34 which opens at the rear 22 of the connector and into which boot 20 is inserted.

Right angle strain relief boot 20 has a cable-receiving passage 36 therethrough and includes a first leg portion 38 and a second leg portion 40 connected by a bend portion 42. The boot is fabricated of flexible material, such as a plastic or semi-rigid polymer. First leg portion 38 is coupled to connector 14 so that the first leg portion extends along longitudinal connector axis 18 and defines a proximal end 44 of the boot. Second leg portion 40 extends transversely or at a right angle to longitudinal connector axis 18 and defines an open distal end 46 of the boot from which optical fiber cable 12 extends, as seen in Figure 2, when the cable is in its normal strain relieved position within passage 36 of the boot.

Generally, complementary interengaging coupling means are provided between proximal end 44 of boot 20 and connector 14 allowing rotation of the boot about longitudinal connector axis 18. More particularly, referring specifically to Figure 2, inner body 24 of connector 14 includes an outwardly projecting circumferential flange 48, and proximal end 44 of boot 20 includes an inwardly opening circular groove 50. It can be seen that the rear edge of flange 48 is angled or chamfered. Therefore, the boot is assembled to the connector by pushing the boot in the direction of arrow "A" (Fig. 1), whereby proximal end 44 of the boot will enter cavity 34 of outer housing 26 and into engagement with chamfered flange 48. Since the boot is flexible, the boot will snap over the flange until the flange seats into groove 50 within the proximal end of the boot. It can be seen that the front edge of flange 48 is generally abrupt for abutting a front shoulder of groove 50 to prevent unintentional pulling of the boot out of the connector, whereby the boot performs its strain relief function for cable 12 once assembled to the connector as shown in Figure 2.

Generally, the invention contemplates means whereby optical fiber cable 12 can be moved from its contained position within boot 20 as shown in Figure 2, to a position extending axially from connector 14 as shown in Figure 1, to allow boot 20 to be rotated about longitudinal connector axis 18 to various angular orientations relative to connector 14, without twisting the optical fiber cable. More particularly, a slot opening 52 is formed in the boot and extends from the open distal end 46 thereof, generally to and preferably through bend portion 42 in the boot, to a closed end 54 of the slot opening. The slot narrows near the open end 46 of the boot to define a mouth or restriction 52a. In the preferred embodiment of the invention, the width of mouth 52a is narrower than the diameter of cable 12, and the width of the remainder of slot 52 is approximately the same as the diameter of the cable. Therefore, the cable can snap into and out of passage 36 past mouth 52a, but freely move within slot 52. In essence, the circumference of boot 20 in the area of mouth 52a retains the cable within passage 36 to provide a controlled bending of the cable as best seen in Figure 2, while the boot still provides strain relief for the cable.

In an actual example, cable 12, passage 36 and the width of slot 52 all may be on the order of 3 mm (0.118 inch). Mouth 52a may have a width on the order of 0.5

mm (0.020 inch).

In operation or use, cable 12 is terminated to connector 14, and right angle boot 20 is coupled to the connector as shown in Figure 2. The cable is encapsulated by the boot to provide a controlled bending for the cable and avoid twisting or kinking of the cable. This would be a normal condition for use of the assembly or system shown. However, should it be desirable for the cable to extend from the connector at a different angle from that shown in Figure 2, cable 12 is moved out of second leg portion 40 of the boot, past mouth 52a of slot 50, to a position projecting from the connector and first leg portion 44 of the boot on longitudinal axis 18 of the connector. This is shown by the position of the cable in Figure 1, and the phantom position of the cable shown at 12' in Figure 2. With the cable in this straight line position extending away from connector 14, boot 20 can be rotated about axis 18 without uncoupling the boot from the connector and without removing the cable from the connector. Once the boot is in a new desired angular orientation, cable 12 can be snapped back past mouth 52a and into passage 36 of the boot. It can be seen that such an adjusting procedure of the relative angular orientation between boot 20 and connector 14 can be performed without twisting cable 12, because the cable has been moved to a straight line position on longitudinal connector axis 18 which is the rotational axis of the boot.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

Claims

1. Right angle strain relief system (10), including a connector (14) terminating a distal end (32) of a cable (12) and having a longitudinal connector axis (18), and a right angle strain relief boot (20) extending from the connector, the boot having a cable-receiving passage (36) therethrough, the boot having a first leg portion (38) and a second leg portion (40) connected by a bend portion (42), the first leg portion (38) being coupled to the connector, extending along said longitudinal connector axis, and defining a proximal end (44) of the boot, the second leg portion (40) extending transversely of the longitudinal connector axis (18) and defining an open distal end (46) of the boot through which the cable extends, and complementary interengaging coupling means (48, 50) between the proximal end of the boot (20) and the connector (14) allowing rotation of the boot about the longitudinal connector axis (18), and a slot opening (52, 52a) extending along the boot (20) characterized in that said slot opening (52, 52a) extends from the open distal end (46) of the boot into the bend portion (42) but not through the first leg portion (38), the slot opening (52, 52a) being of a width to allow the cable (12) to be moved outwardly of the second leg portion (40) to a position projecting from the first leg portion (38) generally on the longitudinal connector axis (18), whereby, with the cable (12) moved out of the second leg portion (40), the boot (20) can be rotated relative to the connector without twisting the cable.

2. Right angle strain relief system as set forth in claim 1, wherein said boot (20) is fabricated of flexible material and said slot opening (52, 52a) includes a mouth (52a) near the distal end (46) of the boot, the mouth being narrower than the cable to provide a snap-fitting restriction for the cable to pass into and out of the cable-receiving passage.

3. Right angle strain relief system as set forth in claims 1 or 2, wherein said bend portion (42) in the boot forms generally forwardly and rearwardly facing sides of the boot, the rearwardly facing side being defined by the outer radius of curvature of the bend portion, and the slot opening (52, 52a) is located in the rearwardly facing side of the boot.

4. Right angle strain relief system as set forth in claim 2, wherein the width of said slot opening (52, 52a) excluding the mouth (52a) is approximately the same as the diameter of the cable (12).

5. Right angle strain relief system as set forth in claims 1 to 4, wherein said slot opening (52, 52a) extends from the open distal end (46) of the boot substantially through the bend (42) in the boot.

6. Right angle strain relief system (10) an set forth in claims 1 to 5 for an optical fiber cable (12), including a fiber optic connector (14) for terminating an optical fiber (16) of the cable (12) on the longitudinal connector axis (18).

7. Right angle strain relief system as set forth in claim 6, wherein said bend portion (42) in the boot forms generally forwardly and rearwardly facing sides of the boot, the rearwardly facing side being defined by the outer radius of curvature of the bend portion, and the slot opening (52,52a) is located in the rearwardly facing side of the boot.

8. Right angle strain relief system as set forth in claims 6 or 7, wherein said boot (20) is fabricated of flexible material and said slot opening (52, 52a) includes a mouth (52a) near the distal end (46) of the boot, the mouth being narrower than the cable to provide a snap-fitting restriction for the cable to pass into and out of the cable-receiving passage.

9. Right angle strain relief system as set forth in claim 8, wherein said bend portion (42) in the boot forms generally forwardly and rearwardly facing sides of the boot, the rearwardly facing side being defined by the outer radius of curvature of the bend portion, and the slot opening (52, 52a) is located in the rearwardly facing side of the boot.

Patentansprüche

1. Abgewinkeltes Zugentlastungssystem (10) umfassend einen Verbinder (14), der an dem ferngelegenen Ende (32) eines Kabels (12) angeschlossen ist und eine Verbinderlängsachse (18) aufweist und einen abgewinkelten Zugentlastungsschuh (20) aufweist, der sich vom Verbinder erstreckt, wobei ein kabelaufnehmender Durchgang (36) durch den Schuh verläuft, wobei der Schuh einen ersten Armabschnitt (38) und einen zweiten Armabschnitt (40) aufweist, die durch einen Biegeabschnitt (42) verbunden sind, wobei der erste Armabschnitt (38) an den Verbinder gekoppelt ist, sich entlang der Verbinderlängsachse erstreckt und ein nahegelegenes Ende (44) des Schuhs definiert, wobei sich der zweite Armabschnitt (40) quer zur Verbinderlängsachse (18) erstreckt und ein offenes ferngelegenes Ende (46) des Schuhs, durch welchen sich das Kabel erstreckt, definiert und mit komplementären in Eingriff stehenden Kopplungsmitteln (48, 50) zwischen dem nahegelegenen Ende des Schuhs (20) und dem Verbinder (14), welche die Drehung des Schuhs um die Verbinderlängsachse (18) erlauben, und mit einer Schlitzöffnung (52, 52a), die sich entlang des Schuhs (20) erstreckt,
dadurch gekennzeichnet, daß sich die Schlitzöffnung (52, 52a) von dem offenen ferngelegenen Ende (46) des Schuhs in den Biegebereich (42), jedoch nicht durch den ersten Armabschnitt (38) erstreckt, wobei die Schlitzöffnung (52, 52a) eine Breite aufweist, die es dem Kabel (12) gestattet, aus dem zweiten Armabschnitt (40) heraus in eine Stellung, die vom ersten Armabschnitt (38) im wesentlichen entlang der Verbinderlängsachse (18) verläuft, bewegt zu werden, wobei bei aus dem zweiten Armabschnitt (40) herausbewegten Kabel (12) der Schuh (20) relativ zum Verbinder verdrehbar ist, ohne das Kabel zu verdrehen.

2. Rechtwinkliges Zugentlastungssystem nach Anspruch 1, bei welchem der Schuh (20) aus flexiblem Material hergestellt ist und die Schlitzöffnung (52, 52a) ein Maul (52a) nahe dem ferngelegenen Ende (46) des Schuhs aufweist, wobei das Maul schmaler als das Kabel ist, um eine Schnapp-Befestigungs-Halterung für das Kabel beim Hinein- und Heraustreten in/aus dem kabelaufnehmenden Durchgang zu bilden.

3. Rechtwinkliges Zugentlastungssystem nach Anspruch 1 oder 2, bei welchem der Biegeabschnitt (42) in dem Schuh im wesentlichen eine vorwärts- und eine rückwärtsgerichtete Seite des Schuhs ausbildet, wobei die rückwärtsgerichtete Seite durch den Außenradius der Krümmung des Biegebereichs definiert ist und die Schlitzöffnung (52, 52a) in der rückwärtsgerichteten Seite des Schuhs angeordnet ist.

4. Rechtwinkliges Zugentlastungssystem nach Anspruch 2, bei welchem die Breite der Schlitzöffnung (52, 52a) mit Ausnahme des Mauls (52a) ungefähr den gleichen Durchmesser wie das Kabel (12) aufweist.

5. Rechtwinkliges Zugentlastungssystem nach einem der Ansprüche 1 bis 4, bei welchem sich die Schlitzöffnung (52, 52a) vom offenen ferngelegenen Ende (46) des Schuhs im wesentlichen durch den Biegebereich (42) im Schuh erstreckt.

6. Rechtwinkliges Zugentlastungssystem (10) nach einem der Ansprüche von 1 bis 5 für ein optisches Faserkabel (12) mit einem faseroptischen Verbinder (14) für den Anschluß an eine optische Faser (16) des Kabels (12) an der Verbinderlängsachse (18).

7. Rechtwinkliges Zugentlastungssystem nach Anspruch 6, bei welchem der Biegebereich (42) in dem Schuh sich im wesentlichen vorwärts- und rückwärtsgerichtete Seiten des Schuhs ausbildet, wobei die rückwärtsgerichtete Seite durch den äußeren Krümmungsradius des Biegebereichs definiert ist und die Schlitzöffnung (52, 52a) in der rückwärtsgerichteten Seite des Schuhs angeordnet ist.

8. Rechtwinkliges Zugentlastungssystem nach Anspruch 6 oder 7, bei welchem der Schuh (20) aus flexiblem Material hergestellt ist und die Schlitzöffnung (52, 52a) ein Maul (52a) nahe dem entfernt gelegenen Ende (46) des Schuhs enthält, wobei das Maul enger als das Kabel ist, um eine Schnapp-Befestigungs-Halterung für das Kabel beim Hinein- und Heraustreten in/aus dem kabelaufnehmenden Durchgang zu bilden.

9. Rechtwinkliges Zugentlastungssystem nach Anspruch 8, bei welchem der Biegebereich (42) in dem Schuh im wesentlichen vorwärts- und rückwärtsgerichtete Seiten des Schuhs ausbildet, wobei die rückwärtsgerichtete Seite durch den äußeren Krümmungsradius des Biegebereichs definiert ist und die Schlitzöffnung (52, 52a) in der rückwärtsgerichteten Seite des Schuhs angeordnet ist.

Revendications

1. Système de soulagement de traction (10) à angle droit, comprenant un connecteur (14) pour raccorder une extrémité distale (32) d'un câble (12) et comportant un axe longitudinal (18) de connecteur, et un manchon (20) de soulagement de traction à angle droit s'étendant du connecteur, le manchon comportant un conduit traversant (36) de réception de câble, le manchon comportant une première partie jambe (38) et une seconde partie jambe (40) reliées par une partie courbée (42), la première partie jambe (38) étant couplée au connecteur, s'étendant le long dudit axe longitudinal de connecteur, et définissant une extrémité proximale (44) du manchon, la seconde partie jambe (40) s'étendant transversalement à l'axe longitudinal (18) de connecteur et définissant une extrémité distale ouverte 46 du manchon, à travers laquelle le câble s'étend, et un moyen de couplage mutuellement coopérant (48, 50) entre l'extrémité proximale du manchon (20) et le connecteur (14) permettant une rotation du manchon autour de l'axe longitudinal (18) de connecteur, et une ouverture en fente (52, 52a) s'étendant le long du manchon (20) ;

   caractérisé en ce que ladite ouverture en fente (52, 52a) s'étend de l'extrémité distale ouverte (46) du manchon dans la partie courbée (42), mais pas à travers la première partie jambe (38), l'ouverture en fente (52, 52a) ayant une largeur permettant de déplacer le câble (12) vers l'extérieur de la seconde partie jambe (40) jusqu'à une position en saillie de la première partie jambe (38), globalement sur l'axe longitudinal (18) de connecteur, ce par quoi, le câble (12) étant retiré de la seconde partie jambe (40), on peut faire tourner le manchon (20) par rapport au connecteur, sans tordre le câble.

2. Système de soulagement de traction à angle droit selon la revendication 1, dans lequel ledit manchon (20) est fabriqué de matière souple et dans lequel ladite ouverture en fente (52, 52a) comprend une embouchure (52a) près de l'extrémité distale (46) du manchon, l'embouchure étant plus étroite que le câble pour fournir un rétrécissement de fixation par encliquetage pour le câble, pour le passer dans et hors du conduit de réception de câble.

3. Système de soulagement de traction à angle droit selon les revendications 1 ou 2, dans lequel ladite partie courbée (42) du manchon forme des côtés faisant face globalement vers l'avant et vers l'arrière du manchon, le côté faisant face vers l'arrière étant défini par le rayon extérieur de courbure de la partie courbée, et dans lequel l'ouverture en fente (52, 52a) est située dans le côté faisant face vers l'arrière du manchon.

4. Système de soulagement de traction à angle droit selon la revendication 2, dans lequel la largeur de ladite ouverture en fente (52, 52a) excluant l'embouchure (52a) est environ la même que le diamètre du câble (12).

5. Système de soulagement de traction à angle droit selon les revendications 1 à 4, dans lequel ladite ouverture en fente (52, 52a) s'étend de l'extrémité distale ouverte (46) du manchon sensiblement d'un bout à l'autre de la partie courbée (42) du manchon.

6. Système de soulagement de traction (10) à angle droit, selon les revendications 1 à 5, pour un câble à fibre optique (12), comprenant un connecteur pour fibre optique (14) pour raccorder une fibre optique (16) du câble (12) sur l'axe longitudinal (18) de connecteur.

7. Système de soulagement de traction à angle droit selon la revendication 6, dans lequel ladite partie courbée (42) du manchon forme des côtés faisant face globalement vers l'avant et vers l'arrière du manchon, le côté faisant face vers l'arrière étant défini par le rayon externe de courbure de la partie courbée, et dans lequel l'ouverture en fente (52, 52a) est située dans le côté faisant face vers l'arrière du manchon.

8. Système de soulagement de traction à angle droit selon les revendications 6 ou 7, dans lequel ledit manchon (20) est fabriqué de matière souple et dans lequel ladite ouverture en fente (52, 52a) comprend une embouchure (52a) située près de l'extrémité distale (46) du manchon, l'embouchure étant plus étroite que le câble pour fournir un rétrécissement de fixation par encliquetage pour le câble, pour le faire passer dans et hors du conduit de réception de câble.

9. Système de soulagement de traction à angle droit selon la revendication 8, dans lequel ladite partie courbée (42) du manchon forme des côtés faisant face globalement vers l'avant et vers l'arrière du manchon, le côté faisant face vers l'arrière étant défini par le rayon extérieur de courbure de la partie courbée, et dans lequel l'ouverture en fente (52, 52a) est située dans le côté faisant face vers l'arrière du manchon.

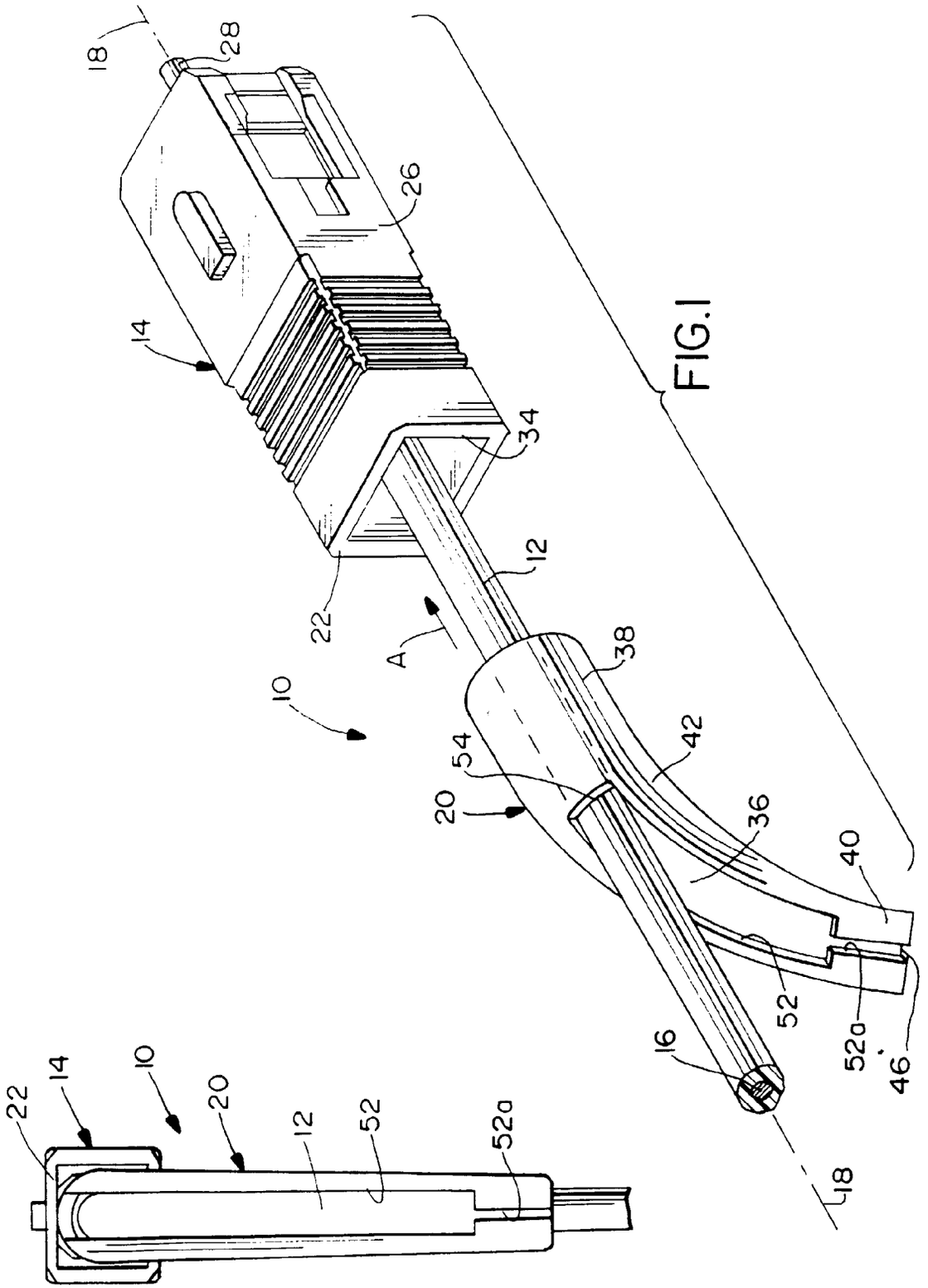
18
28
26
14
34
12
22
A
10
38
54
42
20
36
40
52
52a
46
16
18

FIG.1

22
14
10
20
12
52
52a

FIG.3

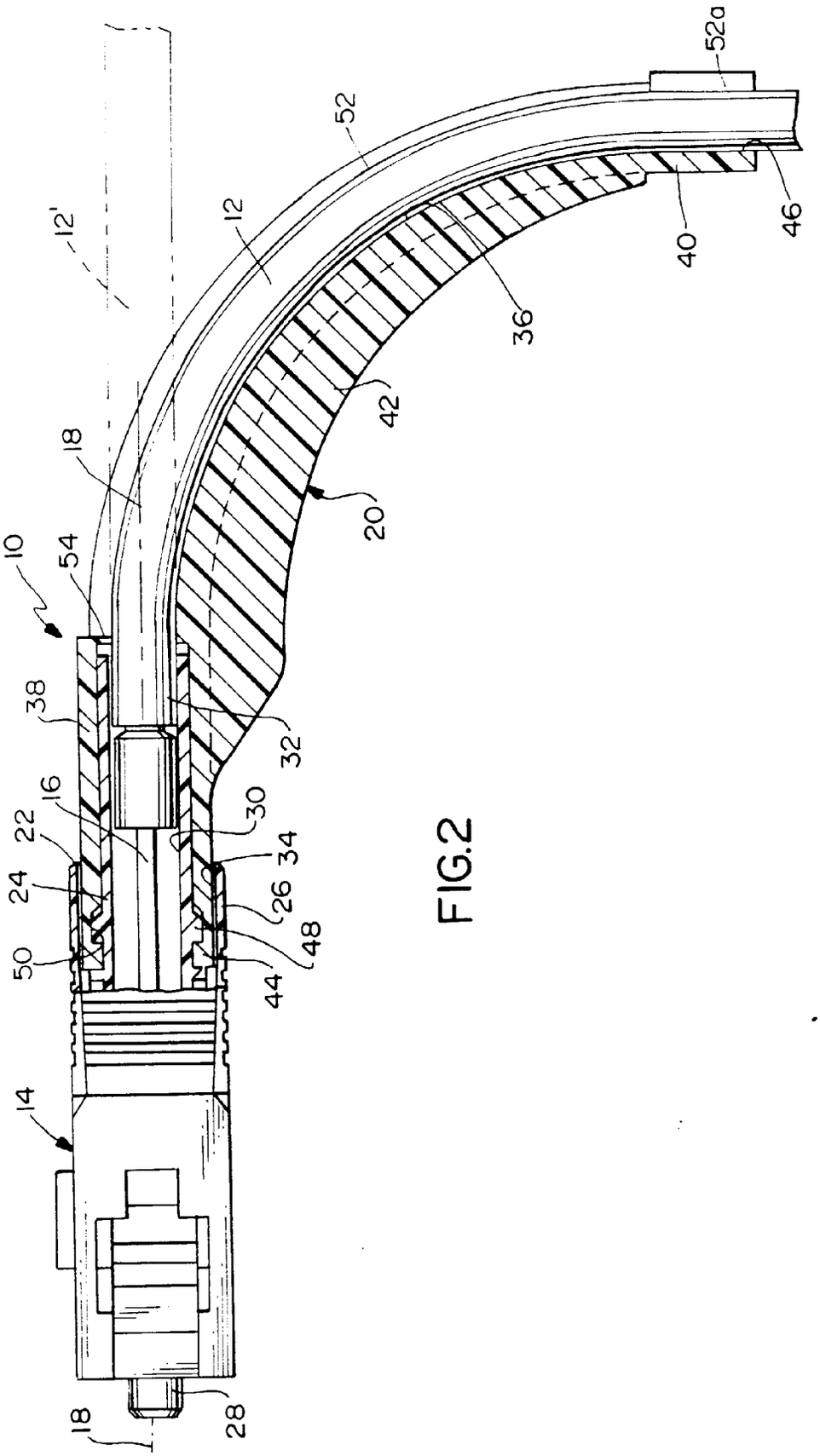
52a
52
12'
12
40
46
36
42
18
20
10
54
38
32
16
30
22
34
24
26
48
50
44
14
18
28

FIG.2